SCIENCE

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ANTARCTIC EXPLORATION.[1]

MY experience during the four years which have elapsed since this project was first mooted in Melbourne, is that any reference to the subject is sure to be met with the query *Cui bono?* What good can it do? What benefit can come from it? What is the object to be served by such an expedition?

In setting myself to the task of answering these questions, let me observe that it would indeed be strange if an unexplored region eight million square miles in area,—twice the size of Europe,—and grouped around the axis of rotation and the magnetic pole, could fail to yield to investigators some novel and valuable information. But when we notice that the circle is engirdled without by peculiar physical conditions which must be correlated to special physical conditions within, speculation is exchanged for a confident belief that an adequate reward must await the skilled explorer. The expected additions to the geography of the region are, of all the knowledge that is to be sought for there, the least valuable. Where so many of the physical features of the country—the hills, the valleys, and the drainage lines—have been buried beneath the snow of ages, a naked outline, a bare skeleton of a map, is the utmost that can be delineated. Still, even such knowledge as this has a distinct value, and, as it can be acquired by the explorers as they proceed about their more important researches, its relatively small value ought not to be admitted as a complete objection to any enterprise which has other objects of importance. Our present acquaintance with the geography of the region is excessively limited. Ross just viewed the coast of Victoria Land, between 163° east and 160° west longitude. He trod its barren strand twice, but on each occasion for a few minutes only. From the adjacent gulf he measured the heights of its volcanoes, and from its offing he sketched the walls of its icy barrier. Wilkes traced on our map a shore-line from 97° to 167° east longitude, and he backed it up with a range of mountains, but he landed nowhere. Subsequently Ross sailed over the site assigned to part of this land, and hove his lead 600 fathoms deep where Wilkes had drawn a mountain. He tells us that the weather was so very clear, that, had high land been within 70 miles of that position, he must have seen it (*Ross's Voyage*, 1278). More recently Nares, in the "Challenger," tested another part of Wilkes's coast-line, and with a like result; and these circumstances throw doubts upon the value of his reported discoveries. D'Urville subsequently followed a bold shore for a distance of about 300 miles from 136° to 142° east longitude, while in 67° south latitude, and between 45° and 60° east longitude are Enderby's and Kemp's lands. Again, there is land to the south of the Horn, which trends from 45° to 75° south latitude. These few discontinuous coast lines comprise all our scanty knowledge of the Antarctic land. It will be seen from these facts that the principal geographical problem awaiting solution is the interconnection of these scattered shores. The question is, do they constitute parts of a continent, or are they, like the coasts of Greenland, portions of an archipelago, smothered under an overload of frozen snow, which conceals their insularity? Ross inclined to the latter view, and he believed that a wide channel leading towards the pole existed between North Cape and the Balleny Islands (*Ross's Voyage*, 1221). This view was also held by the late Sir Wyville Thompson. A series of careful observations upon the local currents might throw some light upon these questions. Ross notes several such in his log. Off Possession Island a current, running southward, took the ships to windward (*Ross's Voyage*, 1195). Off Coulman Island another drifted them in the same direction at the rate of 18 miles a day (*Ross's Voyage*, 1204). A three-quarter knot northerly current was felt off the Barrier, and may have issued from beneath some part of it. Such isolated observations are of little value, but they were multiplied; and were the currents correlated with the winds experienced, the information thus obtained might enable us to detect the existence of straits, even where the channels themselves are masked by ice-barriers.

Finally it is calculated that the centre of the polar ice-cap must be three miles, and may be twelve miles, deep, and that, the material of this ice mountain being viscous, its base must spread out under the crushing pressure of the weight of its centre. The extrusive movement thus set up is supposed to thrust the ice cliffs off the land at the rate of a quarter of a mile per annum. These are some of the geographical questions which await settlement.

In the geology of this region we have another subject replete with interest. The lofty volcanoes of Victoria Land must present peculiar features. Nowhere else do fire and frost divide the sway so completely. Ross saw Erebus belching out lava and ashes over the snow and ice which coated its flanks. This circumstance leads us to speculate on the strata that would result from the alternate fall of snow and ashes during long periods and under a low temperature. Volcanoes are built up, as contradistinguished from other mountains, which result from elevation or erosion. They consist of *débris* piled round a vent. Lava and ashes surround the crater in alternate layers. But in

[1] Address delivered at the annual meeting of the Bankers' Institute of Australasia, Aug. 27, 1890, by G. S. Griffiths.

this polar region the snowfall must be taken into account as well as the ash deposit and the lava-flow. It may be thought that any volcanic ejecta would speedily melt the snow upon which they fell, but this does not by any means necessarily follow. Volcanic ash, the most widespread and most abundant material ejected, falls comparatively cold, cakes, and then forms one of the most effective non-conductors known. When such a layer, a few inches thick, is spread over snow, even molten lava may flow over it without melting the snow beneath. This may seem to be incredible, but it has been observed to occur. In 1828, Lyell saw on the flanks of Etna a glacier sealed up under a crust of lava. Now, the Antarctic is the region of thick-ribbed ice. All exposed surfaces are quickly covered with snow. Snow-falls, ash-falls, and lava-flows must have been heaping themselves up around the craters during unknown ages. What has been the result? Has the viscosity of the ice been modified by the intercalation of beds of rigid lava and of hard-set ash? Does the growing mass tend to pile up, or to settle down and spread out? Is the ice wasted by evaporation, or does the ash-layer preserve it against this mode of dissipation? These interesting questions can be studied round the south pole, and perhaps nowhere else so well.

Another question of interest, as bearing upon the location of the great Antarctic continent, which it is now certain existed in the secondary period of geologists, is the nature of the rocks upon which the lowest of these lava-beds rest. If they can be discovered, and if they then be found to be sedimentary rocks such as slates and sandstones, or Plutonic rocks such as granite, they will at once afford us some data to go upon, for the surface exposure of granite signifies that the locality has been part of a continental land sufficiently long for the weathering and removal of the many thousands of feet of sedimentary rocks which of necessity overlie crystalline rocks during their genesis; while the presence of sedimentary rocks implies the some-time proximity of a continent, from the surfaces of which alone these sediments, as rainwash, could have been derived.

As ancient slate rocks have already been discovered in the ice-clad South Georgias, and as the drag-nets of the "Erebus" and the "Challenger" have brought up from the beds of these icy seas fragments of sandstones, slates, and granite, as well as the typical blue mud which invariably fringes continental land, there is every reason to expect that such strata will be found.

Wherever the state of the snow will permit, the polar mountains should be searched for basaltic dikes, in the hope that masses of specular iron and nickel might be found similar to those discovered by Nordenskiöld at Ovifak, in North Greenland. The interest taken in these metallic masses arises from the fact that they alone, of all the rocks of the earth, resemble those masses of extra-terrestrial origin which we know as meteorites. Such bodies of unoxidized metal are unknown elsewhere in the mass, and why they are peculiar to the Arctic it is hard to say. Should similar masses be found within the Antarctic, a fresh stimulus would be given to speculation. Geologists would have to consider whether the oxidized strata of the earth's crust thin out at the poles; whether in such a case the thinning is due to severe local erosion, or to the protection against oxygen afforded to the surface of the polar regions by their ice-caps; or to what other cause. Such discoveries would add something to our knowledge of the materials of the interior of our globe and their relation to those of meteorites.

Still looking for fresh knowledge in the same direction, a series of pendulum observations should be taken at points as near as possible to the pole. Within the Arctic Circle the pendulum makes about 240 more vibrations per day than it does at the equator. The vibrations increase in number there, because the force of gravity at the earth's surface is more intense in that area; and this, again, is believed to be due to the oblateness of that part of the earth's figure, but it might be caused by the bodily approach to the surface at the poles of the masses of dense ultra-basic rocks just referred to. Thus, pendulum experiments may reveal to us the earth's figure; and a series of such observations recorded, from such a vast and untried area, must yield important data for the physicist to work up. We should probably learn from such investigations whether the earth's figure is as much flattened at the Antarctic as it is known to be at the Arctic.

We now know that in the past the north-polar regions have enjoyed a temperate climate more than once. Abundant seams of paleozoic coal, large deposits of fossiliferous jurassic rocks, and extensive eocene beds, containing the remains of evergreen and deciduous trees and flowering plants, occur far within the Arctic Circle. This circumstance leads us to wonder whether the corresponding southern latitudes have ever experienced similar climatic vicissitudes. Conclusive evidence on this point it is difficult to get; but competent biologists who have examined the floras and faunas of South Africa and Australia, of New Zealand, South America, and the isolated islets of the Southern Ocean, find features which absolutely involve the existence of an extensive Antarctic land,—a land which must have been clothed with a varied vegetation, and have been alive with beasts, birds, and insects. As it also had had its fresh-water fishes, it must have had its rivers flowing and not frost-bound, and in those circumstances we again see indications of a modified Antarctic climate. Let us briefly consider some of the evidence for the existence of this continent. We are told by Professor Hutton of Christchurch that 44 per cent of the New Zealand flora is of Antarctic origin. The Auckland, Campbell, and Macquarie Islands all support Antarctic plants, some of which appear never to have reached New Zealand. New Zealand and South America have three flowering plants in common, also two fresh-water fishes, five seaweeds, three marine crustaceans, one marine mollusk, and one marine fish. Similarly New Zealand and Africa have certain common forms; and the floras and faunas of the Kerguelen, the Crozets, and the Marion Islands are almost identical, although in each case the islands are very small and very isolated from each other and from the rest of the world. Tristan d'Acunha has 58 species of marine *Mollusca*, of which number 13 are also found in South America, six or seven in New Zealand, and four in South Africa (Hutton's *Origin of New Zealand Flora and Fauna*). Temperate South America has 74 genera of plants in common with New Zealand, and 11 of its species are identical (Wallace's *Island Life*). Penguins of the genus *Eudyptes* are common to South America and Australia (Wallace's *Dist. of Animals*, 1399). Three groups of fresh-water fishes are entirely con-

fined to these two regions. *Aphritis*, a fresh-water genus, has one species in Tasmania, and two in Patagonia. Another small group of fishes known as the *Haplochitonidæ* inhabit Tierra del Fuegia, the Falklands, and South Australia, and are not found elsewhere; while the genus *Galaxias* is confined to south temperate America, New Zealand, and Australia. Yet the lands which have these plants and animals in common are so widely separated from each other that they could not now possibly interchange their inhabitants. Certainly towards the equator they approach each other rather more; but even this fact fails to account for the present distribution, for, as Wallace has pointed out, "the heat-loving *Reptilia* afford hardly any indications of close affinity between the two regions" of South America and Australia, "while the cold-enduring *Amphibia* and fresh-water fishes offer them in abundance" (Wallace, *Dist. of Animals*, 1400). Thus we see that to the north interchange is prohibited by tropical heat, while it is barred to the south by a nearly shoreless circumpolar sea. Yet there must have been some means of intercommunication in the past, and it appears certain that it took the shape of a common fatherland for the various common forms from which they spread to the northern hemisphere. As this fatherland must have been accessible from all these scattered southern lands, its size and its disposition must have been such as would serve the emigrants either as a bridge or as a series of stepping-stones. It must have been either a continent or an archipelago.

But a further and a peculiar interest attaches to this lost continent. Those who have any acquaintance with geology know that the placental *Mammalia*—that is, animals which are classed with such higher forms of life as apes, cats, dogs, bears, horses, and oxen—appear very abruptly with the incoming of the tertiary period. Now, judging by analogy, it is not likely that these creatures can have been developed out of mesozoic forms with any thing like the suddenness of their apparent entrance upon the scene. For such changes they must have acquired a long time, and an extensive region of the earth; and it is probable that each of them had a lengthy series of progenitors, which ultimately linked it back to lower forms.

Why, then, it is constantly asked, if this was the sequence of creation, do these missing links never turn up? In reply to this query, it was suggested by Huxley that they may have been developed in some lost continent, the boundaries of which were gradually shifted by the slow elevation of the sea-margin on one side and its simultaneous slow depression upon the other; so that there has always been in existence a large dry area with its live-stock. This dry spot, with its fauna and flora, like a great raft or Noah's Ark, moved with great slowness in whatever direction the great earth undulation travelled. But to-day this area, with its fossil evidences, is a sea-bottom; and Huxley supposes that the continent, which once occupied a part of the Pacific Ocean, is now represented by Asia.

This movement of land-surface translation eastwards eventually created a connection between this land and Africa and Europe; and if, when this happened, the *Mammalia* spread rapidly over these countries, this circumstance would account for the abruptness of their appearance there.

Now, Mr. Blandford, the president of the Geological Society of London, in his annual address recently delivered, advances matters a stage further; for he tells us that a growing acquaintance with the biology of the world leads naturalists to a belief that the placental *Mammalia*, and other of the higher forms of terrestrial life, originated during the mesozoic period—still further to the southwards, that is to say—in the lost Antarctic continent, for the traces of which we desire to seek.

But it almost necessarily follows, that, wherever the *Mammalia* were developed, there also man had his birthplace; and, if these speculations should prove to have been well founded, we may have to shift the location of the Garden of Eden from the northern to the southern hemisphere.

I need hardly suggest to you that possibilities such as these must add greatly to our interest in the recovery of any traces of this mysterious region. This land appears to have sunk beneath the seas after the close of the mesozoic. Now, the submergence of any mass of land will disturb the climatic equilibrium of that region, and the disappearance of an Antarctic continent would prove extremely potential in varying the climate of this hemisphere; for to-day the sun's rays fall on the south-polar regions to small purpose. The unstable sea absorbs the heat, and in wide and comparatively warm streams it carries off the caloric to the northern hemisphere, to raise its temperature at the expense of ours. But when extensive land received those same heat-rays, its rigid surfaces, so to speak, tethered their caloric in this hemisphere; and thus, when there was no mobile current to steal northwards with it, warmth could accumulate, and modify the climate.

Under the influences of such changes, the icy mantle would be slowly rolled back towards the south pole, and thus many plants and animals were able to live and multiply in latitudes that to-day are barren. What has undoubtedly occurred in the extreme north is equally possible in the extreme south. But if it did occur,—if south-polar lands, now ice-bound, were then as prolific of life as Disco and Spitzbergen once were,—then, like Spitzbergen and Disco, the unsubmerged remnants of this continent may still retain organic evidences of the fact in the shape of fossil-bearing beds, and the discovery of such deposits would confirm or confute such speculations as these. The key to the geological problem lies within the Antarctic Circle, and to find it would be to recover some of the past history of the southern hemisphere. There is no reason to despair of discovering such evidence, as Dr. M'Cormack, in his account of Ross's voyage, records that portions of Victoria Land were free from snow, and therefore available for investigation, besides which their surface may still support some living forms, for they cannot be colder or bleaker than the peaks which rise out of the continental ice of North Greenland; and these, long held to be sterile, have recently disclosed the existence upon them of a rich though humble flora.

We have now to consider some important meteorological questions. If we look at the distribution of the atmosphere around the globe, we shall see that it is spread unequally. It forms a stratum which is deeper within the tropics than about the poles, and over the northern than over the southern hemisphere, so that the barometer normals fall more as we approach the Antarctic than they do when we near the Arctic. Maury, taking the known isobars as his guide, has calculated that the mean pressure at the north pole is 29.1,

but that it is only 28 at the south (Maury's *Meteorology*, p. 259). In other words, the Antarctic Circle is permanently much barer of atmosphere than any other part of the globe. Again, if we consult a wind-chart, we shall see that both poles are marked as calm areas. Each is the dead centre of a perpetual wind-vortex, but the south-polar indraught is the stronger. Polarward winds blow across the 45th degree of north latitude for 189 days in the year, but across the 45th degree of south latitude for 209 days. And while they are drawn in to the north pole from over a disk-shaped area 5,500 miles in diameter, the south-polar indraught is felt throughout an area 7,000 miles across. Lastly, the winds which circulate about the south pole are more heavily charged with moisture than are the winds of corresponding parts of the other hemisphere. Now, the extreme degree in which these three conditions—of a perpetual grand cyclone, a moist atmosphere, and a low barometer—co-operate without the Antarctic, ought to produce within it an exceptional meteorological state; and the point to be determined is, what that condition may be. Maury maintained that the conjunction will make the climate of the south-polar area milder than that of the north. His theory is, that the saturated winds, being drawn up to great heights within the Antarctic, must then be eased of their moisture, and that simultaneously they must disengage vast quantities of latent heat; and it is because more heat must be liberated in this manner in the south-polar regions than in the north, that he infers a less severe climate for the Antarctic. He estimates that the resultant relative differences between the two polar climates will be greater than that between a Canadian and an English winter (Maury's *Meteorology*, p. 466). Ross reports that the south-polar summer is rather colder than that of the north, but still the southern winter may be less extreme, and so the mean temperature may be higher. If we examine the weather reports logged by Antarctic voyagers, instead of the temperature merely, the advantage still seems to rest with the south. In the first place, when the voyager enters the Antarctic, he sails out of a tempestuous zone into one of calms. To demonstrate the truth of this statement, I have made an abstract of Ross's log for the two months of January and February, 1841, which he spent within the Antarctic Circle. To enable every one to understand it, it may be well to explain that the wind-force is registered in figures from 0, which stands for a dead calm, up to 12, which represents a hurricane. I find that during these 60 days it never once blew with the force 8; that is, a fresh gale. Only twice did it blow force 7, and then only for half a day each time. Force 5 to 6—fresh to strong breezes—is logged on 21 days. Force 1 to 3—that is, gentle breezes—prevailed on 34 days. The mean wind-force registered under the entire 60 days was 3.43; that is, only a four to five knot breeze. On 38 days blue sky was logged. They never had a single fog, and on 11 days only was it even misty. On the other hand, snow fell almost every second day. We find such entries as these: "Beautifully clear weather," and "Atmosphere so extraordinarily clear that Mount Herschel, distant 90 miles, looked only 30 miles distant." And again, "Land seen 120 miles distant, sky beautifully clear." Nor was this season exceptional, so far as we can tell; for Dr. M'Cormack, of the "Erebus," in the third year of the voyage, and after they had left the Antarctic for the third and last time, enters in his diary the following remark. He says, "It is a curious thing that we have always met with the finest weather within the Antarctic Circle; clear, cloudless sky, bright sun, light wind, and a long swell" (M'Cormack's *Antarctic Voyage*, v. i. p. 345). It would seem as if the stormy westerlies, so familiar to all Australian visitors, had given to the whole southern hemisphere a name for bad weather, which as yet, at least, has not been earned by the south-polar regions. It is probable, too, that the almost continuous gloom and fog of the Arctic (Scoresby's *Arctic Regions*, pp. 97 and 137) in July and August have prejudiced seamen against the Antarctic summer. The true character of the climate of this region is one of the problems awaiting solution. Whatever its nature may be, the area is so large and so near to us, that its meteorology must have a dominant influence on the climate of Australia; and on this fact the value of a knowledge of the weather of these parts must rest.

To turn to another branch of science, there are several questions relating to the earth's magnetism which require for their solution long-maintained and continuous observations within the Antarctic Circle. The mean or permanent distribution of the world's magnetism is believed to depend upon causes acting in the interior of the earth, while the periodic variations of the needle probably arise from the superficial and subordinate currents produced by the daily and yearly variations in the temperature of the earth's surface. Other variations occur at irregular intervals, and these are supposed to be due to atmospheric electricity. All these different currents are excessively frequent and powerful about the poles; and a sufficient series of observations might enable physicists to differentiate the various kinds of currents, and to trace them to their several sources, whether internal, superficial, or meteoric. To do this properly, at least one land observatory should be established for a period. In it the variation, dip, and intensity of the magnetic currents, as well as the momentary fluctuations of these elements, would all be recorded. Fixed term days would be agreed on with the observatories of Australia, of the Cape, America, and Europe; and during these terms a concerted continuous watch would be kept up all round the globe to determine which vibrations were local, and which general.

The present exact position of the principal south magnetic pole has also to be fixed, and data to be obtained from which to calculate the rate of changes, in the future; and the same may be said of the foci of magnetic intensity and their movements. In relation to this part of the subject, Capt. Craik recently reported to the British Association his conclusions in the following terms. He says, "Great advantage to the science of terrestrial magnetism would be derived from a new magnetic survey of the southern hemisphere, extending from the parallel of 40° south as far towards the geographical pole as possible."

Intimately connected with terrestrial magnetism are the phenomena of auroras. Their nature is very obscure, but quite recently a distinct advance has been made towards discovering some of the laws which regulate them. Thanks to the labors of Dr. Sophus Tromholdt, who has spent a year within the Arctic Circle studying them, we now know that their movements are not as eccentric as they have hitherto appeared to be. He tells us that the Aurora Borealis, with its crown of many lights, encircles the pole obliquely, and

that it has its lower edge suspended above the earth at a height of from 50 to 100 miles; the mean of 18 trigonometrical measurements, taken with a base-line of 50 miles, being 75 miles. The aurora forms a ring round the pole, which changes its latitude four times a year. At the equinoxes it attains its greatest distance from its pole, and at midsummer and midwinter it approaches it most closely, and it has a zone of maximum intensity which is placed obliquely between the parallels of 60° and 70° north. The length of its meridional excursion varies from year to year, decreasing and increasing through tolerably regular periods, and reaching a maximum about every eleven years, when also its appearance simultaneously attains to its greatest brilliancy. Again, it has its regular yearly and daily movements or periods. At the winter solstice it reaches its maximum annual intensity; and it has its daily maximum at from 8 P.M. to 2 A.M., according to the latitude. Thus at Prague, in 50° north latitude, the lights appear at about 8.45 P.M.; at Upsala, 60° north latitude, at 9.30 P.M.; at Bosskop, 70° north, at 1.30 A M Now, while these data may be true for the northern hemisphere, it remains to be proved how far they apply to the southern. Indeed, seeing that the atmosphere of the latter region is moister and shallower than that of the former, it is probable that the phenomena would be modified. A systematic observation of the Aurora Australis at a number of stations in high latitudes is therefore desirable.

Whether or not there is any connection between auroral exhibitions and the weather is a disputed point. Tromholdt believes that such a relationship is probable (*Under the Rays*, 1,283). He says, that, "however clear the sky, it always became overcast immediately after a vivid exhibition, and it generally cleared again as quickly" (*Under the Rays*, 1,235). Payer declares that brilliant auroras were generally succeeded by bad weather (*Voyage of Tegelhoff*, 1324), but that those which had a low altitude and little mobility appeared to precede calms. Ross remarks of a particular display "that it was followed by a fall of snow, as usual" (*Ross's Voyage*, 1312). Scoresby appears to have formed the opinion that there is a relationship indicated by his experience. It is therefore allowable to regard the ultimate establishment of some connection between these two phenomena as a possible contingency. If, then, we look at the eleven-year cycle of auroral intensity from the meteorological point of view, it assumes a new interest; for these periods may coincide with the cycles of wet and dry seasons, which some meteorologists have deduced from the records of our Australian climate, and the culmination of the one might be related to some equivalent change in the other; for if a solitary auroral display be followed by a lowered sky, surely a period of continuous auroras might give rise to a period of continuous cloudy weather, with rain and snow. Fritz considers that he has established this eleven-year cycle upon the strength of auroral records extending from 1583 to 1874, and his deductions have been verified by others.

In January, 1886, we had a widespread and heavy rainfall, and also an auroral display seen only at Hobart, but which was sufficiently powerful to totally suspend communication over all the telegraph-lines situated between Tasmania and the China coast. This sensitiveness upon the part of the electric currents to auroral excitation is not novel, for long experience on the telegraph-wires of Scandinavia has shown that there is such a delicate sympathy between them that the electric wires there manifest the same daily and yearly periods of activity as those that mark the auroras. The current that reveals itself in fire in the higher regions of the atmosphere is precisely the same current that plagues the operator in his office. Therefore in the records of these troublesome earth-currents, now being accumulated at the Observatory by Mr. Ellery, we are collecting valuable data, which may possibly enable the physicist to count the unseen auroras of the Antarctic, to calculate their periods of activity and lethargy, and again to check these with our seasons. But it need hardly be said that the observations which may be made in the higher latitudes, and directly under the rays of the Aurora Australis, will have the greater value, because it is only near the zone of maximum auroral intensity that the phenomena are manifested in all their aspects. In this periodicity of the southern aurora I have named the last scientific problem to which I had to direct your attention; and I would point out, that, if its determination should give to us any clew to the changes in the Australian seasons which would enable us to forecast their mutations in any degree, it would give to us in conducting those great interests of the country which depend for their success upon the annual rainfall an advantage which would be worth, many times over, all the cost of the expeditions necessary to establish it.

Finally, there is a commercial object to be served by Antarctic exploration, and it is to be found in the establishment of a whaling trade between this region and Australia. The price of whalebone has now risen to the large sum of $10,000 a ton, which adds greatly to the possibilities of securing to the whalers a profitable return. Sir James Ross and his officers have left it on record that the whale of commerce was seen by them in these seas, beyond the possibility of a mistake. They have stated that the animals were large and very tame, and that they could have been caught in large numbers. Within the last few years whales have been getting very scarce in the Arctic; and in consequence of this two of the most successful of the whaling-masters of the present day, Capts. David and John Gray of Peterhead, Scotland, have devoted some labor to collecting all the data relating to this question, and they have consulted such survivors of Ross's expedition as are still available. They have published the results of their investigations in a pamphlet, in which they urge the establishment of the fishery strongly, and they state their conclusions in the following words: "We think it is established beyond doubt that whales of a species similar to the right or Greenland whale found in high northern latitudes exist in great numbers in the Antarctic seas, and that the establishment of a whale-fishery within that area would be attended with successful and profitable results." It is not necessary for me to add anything to the opinion of such experts in the business. All I desire to say is, that if such a fishery were created, with its headquarters in Melbourne, it would probably be a material addition to our prosperity, and it would soon increase our population by causing the families of the hardy seamen who would man the fleet to remove from their homes in Shetland and Orkney and the Scotch coasts, and settle here.

In conclusion, I venture to submit that I have been able to point to good and substantial objects, both scientific and

commercial, to justify a renewal of Antarctic research; and I feel assured that nothing could bring to us greater distinction in the eyes of the whole civilized world than such an expedition, judiciously planned, and skilfully carried out.

THE USE OF OIL.

MASTERS of vessels cannot be reminded too often of the use of oil in stormy weather. Its importance is well illustrated by the fact that it is now referred to at length in standard books on seamanship; and the International Marine Conference at Washington recommended that "the several governments require all their sea-going vessels to carry a sufficient quantity of animal or vegetable oil for the purpose of calming the sea in rough weather, together with suitable means for applying it." As a good example of the directions that are now given for the best way to use oil, the remarks in a recently published book on practical seamanship, by Todd and Whall, printed on the "Atlantic Pilot Chart" for October, are of interest:—

"To cross a bar in heavy weather, after battening down all hatches, etc., take two pieces of India-rubber pipe about twenty feet long and one inch in diameter. Put these through the hawse-pipes, one on each side, and let their ends trail in the sea. On the upper end of each piece of tube lash a good-sized funnel, secure it to a stanchion in a vertical position, and station a man at each, with a three-gallon tin of colza-oil. When the vessel enters the outermost sea that breaks on the bar, let each man gently pour the oil down the pipes. This will smooth the bar immensely, and the vessel will steer much better. Almost any oil of animal or vegetable origin will do; but petroleum is not of much service, excepting to mix with and thin the other, if necessary. When lying-to in a gale, head to wind and drifting slowly, if a little oil is used, a ship ought to pull through the heaviest storm. Running in a gale, an oil-bag hung over the weather-side, or oil poured down a pipe well forward, is of great service in preventing the sea from breaking aboard; gale increasing, to round-to, prepare a sea anchor, watch for a smooth spell, and then put the helm down, heave overboard a few gallons of oil, and float the sea-anchor. Keep pouring the oil on the sea down a weather pipe or scupper while the ship is coming up to the wind. A well-equipped sailing-ship, even if deeply laden, will lie-to under a closely reefed topsail or tarpaulin in the rigging, and weather almost any gale, so long as she is not taken aback. Sailing-vessels under these circumstances nowadays often use an oil-bag paid out to windward to smooth the sea still more: this is the ideal position of a laden vessel in a dangerous storm. Whilst towing a disabled ship over a bar, or where the sea is very wicked, a couple of oil-bags over the stern will ease the sea on the tow. In a good steamer, to take a shipwrecked crew off a wreck, run to windward of the wreck, lower the lee boat, put your vessel head to sea and dead to windward, and let the boat drop down toward the wreck, veering out on the line, and constantly pouring considerable oil into the sea, which will keep the sea smooth between your ship and the wreck. In using oil-bags in heavy weather, they should be weighted, if hung over the side, in order to keep them down. When scudding, it is best to pour the oil down the closet-pipes."

NOTES AND NEWS.

WE learn from *Nature* that an expedition to Greenland will start from Denmark next year, under the command of Lieut. Ryder, to investigate the east coast between latitude 66° and 73°.

—At a meeting of the Royal Geographical Society of Australasia, held at Melbourne on Aug. 22, a letter from Sir Thomas Elder was read, in which he offered to bear the entire cost of an expedition to the unexplored regions of Australia. A report on the question of antarctic exploration was also submitted to the meeting. In this report, according to *Nature* of Oct. 9, it was stated that public interest in the subject had been revived by the announcement that Baron A. E. Nordenskiöld, after a conference with his friend Baron Oscar Dickson, had consented to take the command of an expedition to the south-polar regions, on the condition that the Australian colonies contributed a sum of $25,000 towards the expenses. Baron Dickson having offered to advance the other moiety, or whatever more might be necessary. "The offers were cordially accepted, and the antarctic committee felt itself justified in making the necessary arrangements without delay for collecting the amount to be contributed by the Australasian colonies. The council of the society had passed resolutions recognizing a national duty in the exploration of the antarctic regions, especially that portion lying opposite to Australasia, pledging itself to use its influence in promoting the enterprise, and giving authority to head a subscription list in aid of the Swedish Australian Exploration Fund with a donation of $1,000 from the society's funds. It would appear, from the hearty reception accorded to the proposals of the antarctic committee, that the latter might rely upon the energetic co-operation of all the scientific societies of Australasia, and thus be enabled to collect the amount of the contribution promised towards defraying the expenses of the combined Swedish and Australian Exploring Expedition to the South Polar Regions." The report, on being put to the meeting, was "received with acclamation."

—Mr. Robert Swordy of Dryburn Cottage, Durham, in a letter to *Nature*, the substance of which was printed in that journal for Oct. 9, gives an account of a toad (*Bufo vulgaris*) which he saw crawling out of the Pond Wood at Aykleyheads. The muscles of the toad's body were (as usual) arranged in such a fashion that the back of the toad looked like minute nodules of dark gravel embedded in a damp path below trees; but what seemed to Mr. Swordy most remarkable was, that on the top of this gravel-like arrangement of muscles there was spread a mesh or network of very fine lichen, with oval-shaped leaves of a lightish-green color, connected more or less to each other by a hair-like process of stems. This lichen spread irregularly over the toad's back, and odd sprays of it were also to be seen on the legs and upper surfaces of the feet. "Now," says the writer, "had the toad been in its regular haunts under the trees and shrubs, with this wonderful counterfeit of gravel and protective coloring, it would have been almost impossible to discriminate its form from the dark gravel, lichens, moss, wood-sorrel, and dead leaves of the place; and I doubt not that this animal's unobtrusive attire would aid it materially in capturing the insects necessary for its sustenance." Mr. Swordy enclosed photographs of the toad sitting on a section of lichen-colored gravel path, taken from near the spot where he found it.

—The following newspaper anecdote will interest those fond of animals: "A friend of the writer owns a monkey, which answers to the name of 'Jocko.' The children of the house and Jocko are boon companions, and of a summer afternoon enjoy a frolic together upon the lawn. One day some one threw a match down, and the grass ignited, making a little blaze. Jocko saw it, stopped and looked, then glanced all around, and, seeing a piece of plank not far off, ran for it, crept cautiously to the fire, all the time holding the plank as a shield between himself and the flame, then threw the plank on the fire and pressed it down and extinguished it. What child could have reasoned better and done more? Although, perhaps, no danger could have come from the fire, still, no one knows what the result might have been, and the monkey evidently believed that prudence is the better part of valor."

—The students' work in psychology at the University of Toronto, as reported by Professor J. Mark Baldwin in the last number of *The American Journal of Psychology*, has been hitherto general and theoretical. The new curriculum, however, as now ratified by the university senate, provides for more special and advanced courses, and opportunity for research. The recent fire in University College postponed the equipment of the psychological laboratory, but in the plans for the new buildings more ample accommodations are secured. The new laboratory is to be in the restored building in a retired portion of the first floor immediately over the rooms of the physical department. It will comprise two communicating working rooms, each 16 by 21 feet; a professor's private room, to be used also as a special psychological library under charge of a fellow or instructor; and a dark room available